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THE TREATMENT OF TRAUMATIC LESIONS OF THE
KIDNEY, WITH TABLES OF 155 CASES.

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THE KIDNEY, WITH TABLES OF 155 CASES.¹

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THE present discussion is intended to be limited to the treatment of traumatic lesions of the kidney. I shall, therefore, not do more than allude to the pathology, symptoms, and physical signs, and only as to their bearing upon the question of treatment.

In order to stand upon the solid ground of fact, I have had one of my assistants, Dr. George W. Spencer, collect with fair completeness the published cases of renal traumatism since 1878. In that year, Maas² collected 71 cases. In 1888, Grawitz³ added 37 cases, making 108 in all. In 1891, Obalinski⁴ gathered together the statistics of Maas, Edler,⁵ and Reczey,⁶ making 120 cases in all. These are, however, only cases of rupture of the kidney.

The total number of cases collected by Dr. Spencer is 155, including—

Gunshot wounds of the kidney	19
Other penetrating wounds of the kidney	8
Rupture of the kidney	118
Partial nephrectomy for rupture	2
Traumatic hydronephrosis	6
Rupture of the ureter	2

155

¹ Read before the American Surgical Association, May 27, 1896.

² Deutsche Zeitschrift für Chirurgie, 1878, Vol. x, p. 126.

³ Archiv für klinische Chirurgie, 1888, xxxviii, p. 419.

⁴ Sammlung klinische Vorträge, N. F., No. 16.

⁵ Archiv für klinische Chirurgie, xxxiv, p. 173.

⁶ Wiener Klinik, 1888.

My own tables cover none of those of Maas, but begin, practically, where he left off. The date of his paper, 1878, may be said to mark fairly well the time when modern antiseptic surgery was generally practised, and also when the modern surgery of the kidney (which really began with Simon's book, in 1874) was fully established. I have grouped my cases into five tables.

(1) Gunshot wounds of the kidney ;

(2) Wounds of the kidney other than gunshot ; and,

(3) Subcutaneous rupture of the kidney, with appended tables of rupture of the ureter and of traumatic hydronephrosis.

(1) *Gunshot Wounds of the Kidney*.—Traumatic lesions have, as a rule, two advantages over the lesions of disease. First, they are apt to be unilateral, so that the other kidney is not injured, though, of course, bilateral injuries do take place (*e.g.*, Table III,¹ 28, 57, and 101), and, secondly, the uninjured kidney is apt to be healthy or fairly healthy. Thus, any surgical interference is apt to be unilateral, and the presumption at least is in favor of the opposite kidney being in such condition that it can supplement the work of the wounded one, whether that be temporarily disabled or nephrectomy itself has to be performed. The existence of only one kidney is considered under the cases of rupture.

Gunshot wounds have two disadvantages, however. First, that the treatment of the kidney alone in many cases cannot be solely considered, because there are very frequently concomitant injuries of other organs. Thus, in my own case (I, 4) there were two wounds of the stomach, one of the liver, the intestine was perforated, and a mesenteric artery was cut. These not uncommon associated injuries both complicate the recovery from the renal wound, prolong any operation, it may be, very seriously, and so obscure the conclusions as to the treatment of the kidney alone. In addition to this, especially if the part wounded is in the loin, some of the clothing, or in case a rib or vertebra be fractured, some of the bone, may easily be carried into the wound. Two such cases are quoted by Morris.² In one case, after seven months, the piece of clothing was passed by the urethra after causing the most prolonged and severe suffering.

¹ In later references, I, II, III, etc., will refer to Table I, Table II, etc., and the numbers to the number of the case in that Table.

² Surgical Diseases of the Kidney, p. 159.

The treatment of gunshot wounds of the kidney will vary with the nature and also the extent of the lesion. They may be divided into—

- (1) Wounds involving only the renal substance;
- (2) Wounds involving the pelvis ;
- (3) Wounds involving the vessels ; and,
- (4) Wounds involving the ureter.

(1) Wounds involving the renal tissue. These, happily, especially if only cortical, do not, as a rule, give rise to any extravasation of urine, and, hence, the wounds produced by them, unless infected from without, will generally be perfectly clean wounds, and not become infected from the urine, even though prior infection of the urinary tract should exist. The hæmorrhage is not apt to be very severe, since only the terminal branches of the vessels will be cut. In fact, in many cases, if we could only be sure that only the cortex was involved, we might even be willing to refrain from any surgical interference, and let the wounded kidney get well under simple disinfection, drainage, and dressing with a general symptomatic and expectant treatment.

(2) In wounds involving the pelvis or any of its calyces, the urine always will escape into the surrounding tissue. If the urine be perfectly normal and bland, it is very possible for the wound to escape infection unless other sources of infection exist. Thus, Thornton¹ has recorded a case in which all the urine from one kidney flooded the peritoneal cavity, and yet on opening the abdomen the next day, no sign of peritonitis existed. The bleeding in this case will be, as a rule, much more marked than in wounds of only the renal tissue. It may extend to a distance from the kidney, and so much blood may be poured out as to be an element of serious danger, sometimes overshadowing all other considerations.

(3) The vessels themselves may be implicated by the ball, In Dr. Willard's well-known case,² not only was the pelvis opened, but the renal vessels were divided by the ball, so that the primary hæmorrhage was the most serious symptom, and, in fact,

¹ Transactions of International Medical Congress, 1884, II, p. 154.

² Transactions of American Surgical Association, 1888, VI, p. 505.

destroyed the man's life. The hæmorrhage may extend in several directions. If not extensive, it will form a localized perinephric hæmatoma, but if the vessels have time to pour out much blood, it may extend upward as far as the diaphragm, downward into the iliac fossa, or in the course of the spermatic vessels to the external ring and along the outside of the ureter to the bladder. It may also push its way between the two layers of the mesocolon and even extend into the meso-rectum. All of this hæmorrhage, it will be observed, is retro-peritoneal. Beside that, however, if there be a rent in the peritoneum, there may be, secondly, distinct intra-peritoneal hæmorrhage in addition to retro-peritoneal hæmorrhage. The blood also, thirdly, may pass by the ureter into the bladder. If the cortex alone be injured, there will be no hæmaturia, but if the pelvis or a calyx be injured, and, especially if a large vessel be torn, then the blood will reach the bladder in a very short time by the ureter. There are, however, exceptions to this, as, for example, if the ureter be torn away from the kidney, the blood may very easily be poured out into the perinephric tissues, but not reach the bladder, or even if the ureter be almost or quite intact, clots may form in the ureter, which will effectually block it up, and, for a time at least, prevent any hæmaturia. When the clots are washed out, the hæmaturia will recommence, only to cease again if a new clot forms.

In addition to this, there may be secondary hæmorrhage, which, like the primary hæmorrhage, sometimes kills the patient. None of the cases of gunshot wounds in my table suffered from this accident.

When pure blood passes by the ureter in any large amount, one of the serious complications of wound of the kidney follows, —namely, the accumulation of the blood in the bladder in such quantities as to form firm clots not easily got rid of. The blood may then undergo decomposition, especially if the bladder is diseased, or if a catheter has been used. The resulting cystitis may then infect the original wound or the other kidney and so delay or prevent recovery (I, 17, III, 27).

(4) The ureter may be divided by the ball. According to Morris, there are only one certain and one doubtful case of wound

of the ureter alone by gunshot.¹ The one doubtful case is recorded by Hennen, and the other was that of the Archbishop of Paris, who was wounded in the Revolution of 1848. No wound of the ureter alone occurred in our recent Civil War.

Having now briefly outlined the principal facts in reference to gunshot wounds of the kidney, we come to the question of treatment. Before considering the treatment of the wounded kidney itself, however, I would like to call attention to the treatment of clots in the bladder, and especially the employment of a method which may largely diminish not only the suffering of the patient, but the probabilities of subsequent cystitis and its infective dangers. The method applies not only to gunshot wounds, however, but to all injuries or diseases of the kidney in which the bladder becomes filled with blood-clot and the abdomen has to be opened. Willard (I, 6) deserves the credit of proposing and actually carrying it out in his case of gunshot wound of the kidney. The bladder being full of clots when it was exposed by abdominal section and its walls found to be intact, he simply removed all of the clotted blood in the bladder by squeezing it with his hands.

In cases in which the abdomen is not opened, a large catheter will generally give exit to the urine. In others, especially, is there any serious trouble in emptying the bladder by the catheter, Bigelow's large evacuator will answer still better. If the abdomen be not opened, then to prevent clots from continuous hæmaturia, either nephrectomy must be done or the bladder opened and drained, whichever is indicated by the condition of the patient and the amount of the hæmorrhage.

If the surgeon has reasonable evidence that the kidney has been probably traversed by a ball (and all the more so if it is certain that it has been so wounded), and the patient is evidently in grave danger, as shown by the general symptoms of internal hæmorrhage and by the physical signs of a large lumbar hæmatoma or of intra-peritoneal bleeding, I take it for granted that all of us would recommend an exploratory operation with a view of determining the extent of the injury to the kidney and the proper treatment.

¹ Loc. cit., p. 176.

Shall the incision be abdominal or lumbar? In rare cases the ball may enter by the loin, or from in front, and emerge so near that we can be quite positive that the injury is limited to the kidney. In such cases it is best to attack the kidney through a lumbar incision. In most cases the probability that the other viscera of the abdomen have been injured is so great, and the positive evidence or absence of such complication may come so late, that if we are called to the primary treatment of such a wound, it may be taken for granted that if any incision is required, it should be an abdominal one, either median, so as to be able to reach any part of the abdomen, or, if the course of the ball shows that only the viscera on one side of the abdomen could have been injured, it would be admissible to make Langenbuch's incision at the border of the rectus. Naturally, the first thing to do is to discover whether primary hæmorrhage is still going on, and, if so, to ligate the vessels at once. If the vessels be badly torn, so that not only there has been a great deal of hæmorrhage, but the integrity of the organ, both as to its vitality and its later secreting power, is greatly threatened, and all the more if the pelvis has been at all widely torn, immediate nephrectomy, in my opinion, should be performed.

The mortality in these cases will always be high. Not so much on account of the nephrectomy as on account of the extensive hæmorrhage which has already taken place, and probably reduced the patient wellnigh to the verge of the grave, and also by reason of the shock and the implication of other viscera. In Willard's case, no other course was open to him. It is useless to hope that a kidney so injured can retain its vitality or recover its function.

(2) If the renal substance alone is only moderately injured, I think none of us would be willing to do a primary nephrectomy. The bleeding will not be extensive, little or no urine will be poured out, and there is absolutely no reason why such a wound should not get well just as a wound in any other organ. Moreover, we know perfectly well now, not only from experiments upon animals, but from actual cases in man, that wounds, even gunshot wounds of the kidney, will get well just as any other wound. In these cases simple disinfection, gauze packing, drainage, and symptomatic treatment are indicated (I, 8, 11, 16).

Between these two extremes, however, there comes a debatable class, more numerous, in fact, than either of the others, in which reasonable doubt may exist. The renal substance may be very deeply wounded, the kidney may be penetrated just short of entering the pelvis, or the pelvis itself may be opened without serious wound of any large branch of the renal artery. It is in these cases that experience must decide what is best to be done. My own case, which was the first nephrectomy reported for gunshot wound of the kidney, had practically recovered from the nephrectomy, but died after two weeks from gangrene of the bowel, caused by an injury by the ball before it struck the kidney. I think, however, were I to meet with a case similar to my own again, I should be disposed to test the reparative powers of nature, and I certainly should do so if it were an uncomplicated wound of the kidney.

No one would think of removing a kidney and throw upon the other organ whose integrity we may think is probable, but of which we cannot be sure, the burden of taking up the double work of itself and its fellow and test the ability of the patient to recover from a serious operation unless obliged to do so; and it must also not be forgotten that the other kidney may even be absent (III, 9). If by simply cleansing the wound and a lumbar incision and drainage we can attain the healing of the kidney, this is clearly the proper course. Hence, in this third class of doubtful cases, each one must be decided upon its own merits. The nearer it approximates to a case of simple grazing, or if there is even perforation of the renal substance, the more sure we may be of the propriety of letting the kidney remain in place. The more nearly it approximates the cases in which severance of large vessels has occurred with wide perforation of the pelvis, the more disposed we should be to do an immediate nephrectomy. If in doubt we should lean to the conservative course and preserve the kidney.

Another serious question, however, arises in case the kidney is not removed,—namely, the treatment of the extravasated blood. In my own case, I was confronted with this at the time of operation, as a mesenteric artery had been severed by the ball on its way to the kidney. There was spread out between the two leaflets of the mesentery a thin but extensive fan-shaped clot. Of

course, I tied the mesenteric vessel and so prevented further addition to the clot, but I left the latter untouched. Infection took place in consequence of gangrene of the bowel and destroyed the girl's life by peritonitis. If the bleeding is into the peritoneal cavity, the blood must be removed by abdominal section, of course. If the blood accumulates in the perinephric tissues alone, if not large in amount, it may be left undisturbed, and, if necessary, be evacuated at a later period, which, I think, is, on the whole, the more judicious course. Blood between the two layers of the mesocolon cannot possibly be wholly removed in its entirety, and if an attempt is made at partial removal, the danger of infection is increased very greatly, to say nothing of the extensive injury necessarily inflicted.

If the blood accumulates in a hæmatoma of large size, there can be no possible question as to what ought to be done, because such a mass of blood will inevitably undergo later degeneration and form an abscess, fraught with great danger. In such cases, the whole enormous clot should be turned out and the cavity be disinfected and drained through an incision in the loin, or if cœliotomy has been done, lumbar drainage may be provided in addition.

I have collected in Table I, nineteen cases of gunshot wound which I think bear out the above deductions. Of these, ten recovered and nine died, four dying with and five without nephrectomy. In five of the nineteen cases nephrectomy was done, of whom four died, a deceptive mortality (80 per cent.) when we examine them in detail. In one of these (Case 4) the fatal result was independent and, in fact, in spite of the nephrectomy; in another (Case 6) hæmorrhage had already doomed the man; the third (Case 17) died from suppuration in the other kidney; and the fourth (Case 15) from nephritis in the other kidney. Only the last two deaths, therefore, are properly to be charged to the operation. In the five dying without nephrectomy, three died of peritonitis and two (Cases 13 and 14) of hæmorrhage. Of the ten which recovered, those of Mayo (Case 8), Dalton (Cases 9 and 10), Tiffany (Case 11), and Richardson (Case 16) teach especially important lessons. In Mayo's case, there were two perforations of the intestine, a wound of the omentum and per-

foration of the pleura, the kidney being perforated and blood in the abdominal cavity. Abdominal section and lumbar drainage saved both the kidney and the patient. In Dalton's two cases, though the abdomen in one and the pleura and the abdomen in the other were traversed by the ball, yet there being no evidence of serious internal hæmorrhage and none of wound of the intestine (the liver dulness not having disappeared), abdominal section was not done and conservative surgery was justified by the happy result in each.

In Richardson's case (Case 16) the liver and kidney were both perforated, the latter seriously, and there was free intra-peritoneal hæmorrhage, yet abdominal section, removal of the clots, and drainage of the renal wound was followed by cure.

In Tiffany's, both the spleen and the kidney were perforated, yet ligature of the spleen and gauze tamponnade and drainage of the kidney saved the kidney and the patient.

It is probable, also, that in rare cases in which one end of the kidney has been badly lacerated by the ball, partial nephrectomy may be of service. (*Vide infra.*)

(2) *Wounds of the Kidney other than Gunshot.*—These are usually inflicted by knives, dirks, scissors, scythes, and other similar weapons. (1) In wounds of the kidney which are not the result of gunshot, again, only one kidney is usually involved; (2) the other kidney is, as a rule, healthy; (3) no foreign bodies are apt to be carried in as they are in gunshot; and (4) other organs are not usually involved, unless the stab is from in front, and then, as a general rule, the kidney is not reached. One case has been reported in which a pitchfork entered the anus, tore the rectum, and lacerated the upper third of the left kidney.

The wounds may involve (1) the renal substance alone; (2) they may lay open the pelvis without wounding the large vessels; and (3) the vessels themselves may be divided.

If the renal tissue alone is injured, no urine will be poured out and only a moderate quantity of blood, which will accumulate either in the peritoneal cavity, if that has been opened, or, as these penetrating wounds are more commonly from behind, will more often accumulate in the retro-peritoneal tissues. If the pelvis is opened, the urine and blood will again accumulate,

either in the peritoneal cavity or in the retro-peritoneal tissues, according to the nature of the wound, and there will be hæmaturia. If the vessels are divided, the hæmorrhage will be, as a rule, very considerable and may be enormous. There may be, however, no hæmaturia whatever, as the blood may be poured out either into the perinephric tissues or into the peritoneum with such ease that none of it may enter the bladder, as in a case described by Morgagni and quoted by Morris.¹ As a rule, recovery from these wounds is much more frequent and uncomplicated than in the case of gunshot wounds, where the injury of the tissues is much greater and the complications from injury of other organs more apt to occur. Morris² reports eight cases of recovery, and in the "Surgical History of the War of the Rebellion," Otis has gathered fourteen cases of recovery. Perinephric abscess is not uncommon as a result of infection.

The first question that arises is as to the treatment of prolapse of the kidney if the wound is sufficiently large for this to occur. Two most remarkable cases of this kind are quoted by Pilcher³ and other authors. The first was a man who was stabbed in the left hypochondrium, and a few hours later, as a result of cough, the kidney protruded through the wound. The kidney was replaced "by a friend," who, presumably, was in anything but an aseptic condition, but protrusion recurred. He was seen by Professor Brandt the next day apparently in excellent health, so much so that he walked to a photograph gallery where his picture was taken. The kidney was cut nearly in half lengthwise and was pouring out clear urine. On the fourth day, the pedicle was ligated and the kidney removed. He made a speedy recovery.

The second case was an Arab girl who was stabbed with a knife in the loin. The right kidney protruded from the wound, the pedicle was tied and gradually tightened, and only at the end of six weeks was the kidney removed; in spite of which rather extraordinary treatment she recovered.

Otis also mentions a third case of wound, four and a half

¹ Surgical Diseases of the Kidney, p. 156.

² Page 167, et seq.

³ Annals of Surgery and Anatomy, I, 51.

inches long, from a scythe, through which the kidney protruded. The blood was removed, the kidney returned, and the patient made a rapid recovery.

Case 4, Table II, is another case of a protruding gangrenous kidney in a filthy patient, who, though the kidney was treated by bird-dung and saliva, recovered without shock, as is so common among Orientals. Another case is reported by Vernon.¹

It is evident, therefore, that the protrusion is merely an accident, and that if the condition of the kidney is such as to permit it, it should be sutured and replaced after proper disinfection. Even quite a deep cut should be thus treated, for it has been proved so repeatedly that the kidney heals kindly after extensive nephrotomies, in which the kidney often has been drawn outside of the body for purposes of exploration and treatment, that there can be no doubt as to the propriety of this method of treatment.

If the pelvis of the kidney is opened, though I believe there have been no cases actually reported, I should be disposed, after suitable disinfection, to replace it and drain, having sutured the pelvis if possible. This is exactly in the line of repeated experiences in surgical operations for removal of stones from the pelvis of the kidney with, however, one marked and important difference. If the pelvis has been opened by the surgeon, it is done antiseptically, and there is little chance for the urine to infiltrate the perinephric tissues, whereas in such wounds as are now under consideration, they are always inflicted by septic instruments, and usually several hours elapse before the proper treatment can be instituted, during which time the urine infiltrates the tissues to a very considerable extent. In spite of this difference, however, the treatment should be the same plus a more strenuous disinfection.

If a portion of the kidney is so far severed that its future integrity is threatened, it would be best to remove the fragment, doing a partial nephrectomy. A notable instance of the accidental removal of one-third of one kidney along with a renal

¹ St. Bartholomew's Hospital Reports, 1866.

tumor is reported by Sir Spencer Wells,¹ and the patient made an excellent recovery. The peritoneum was not sutured, which, as a rule, would not be the wiser course. Two cases of partial nephrectomy, by Keetley and Bardenheuer, are included in Table IV, in which resection of one-third of its substance has been followed in each case by recovery. Besides the experimental researches of Bradford,² Barth,³ and Tuffier,⁴ there are recorded at least ten other cases of partial resection for tumors, tuberculosis, or stone, of which a list is appended.⁵

Table No. II of this paper covers eight cases of wounds of the kidney inflicted by other weapons than gunshot. Of these, six recovered and two died, one of coma from suppression of urine, and one of sepsis, a mortality of 20 per cent. In four, nephrectomy was done, at least two operations being only required as a secondary procedure; all four recovered. A study of these, and as well as our knowledge of preceding cases, would seem to justify the following conclusions as to treatment.

(1) The usual external disinfection should be scrupulously carried out.

(2) Both for examination and for the arrest of hæmorrhage, the primary wound should be enlarged if necessary. The kidney itself should be examined with great care, and it and the entire interior of the wound disinfected.

(3) All hæmorrhage should be arrested, of course, as quickly as possible.

(4) If the kidney is unwounded, a temporary drain may be placed in the wound and the greater part of it closed.

¹ British Medical Journal, 1884, I, 758.

² British Medical Journal, 1895, I, 1038.

³ ANNALS OF SURGERY, November, 1892, 449.

⁴ Archives Générale de Médecine, July 18, 1891.

⁵ Czerny, Deutsche Zeitschrift für Chirurgie, XXXIV, 1892, 101. Cramer, Deutsche Zeitschrift für Chirurgie, XLII, 1896, 603. Kümmel, Archiv für klinische Chirurgie, XLVI, 1893, 310. Kümmel (two cases), Centralblatt für Chirurgie, 1890 No. 18. Socin, British Medical Journal, July 13, 1889. Tuffier, Archives Générale de Médecine, July 18, 1891. Fenger, ANNALS OF SURGERY, December, 1895, 804. Recamier, Centralblatt für Chirurgie, 1893, 803. Tiffany (unpublished), for tuberculosis. Recovery with fistula, which may necessitate later total nephrectomy.

(5) If the kidney is wounded also, this wound should be sutured or a partial nephrectomy be done, followed by drainage and partial closure of the wound.

(6) If the pelvis be opened, it should be sutured, if possible, and the wound drained.

(7) If the large vessels are cut, or the kidney itself is lacerated beyond the point at which it would probably retain its vitality and recover its function, immediate nephrectomy should be done.

(8) If in spite of disinfection, as a result of the primary wound, perinephric abscess should follow, this should be widely opened and thoroughly drained, and if the kidney be hopelessly involved or the condition of the patient so serious as to demand it, secondary nephrectomy should be done.

(9) If the peritoneal cavity has been entered by the vulnerating body, carrying infection in its course, and all the more if other viscera be involved, abdominal section should be done at once, the kidney treated as above indicated and other lesions remedied.

(3) *Subcutaneous Rupture of the Kidney.*—Under the term rupture, I include contusions, lacerations, and rupture; terms which are used, at least the last two, interchangeably, and as for contusion it is necessarily attended with intracapsular rupture of the renal substance to a greater or less extent (*e.g.*, III, 76, 85, 86). In many, if not in most cases of contusion in the renal region, no incision is made; it is impossible to say whether the lesion has been a subcapsular rupture,—*i.e.*, contusion proper or an open rupture. Hence, clinically, the distinction between a contusion and a rupture cannot be made and the treatment of both must be considered together.

As a rule, injuries of the kidney producing ruptures are unilateral, and affect, therefore, but a single kidney. Occasionally, they are bilateral and involve both kidneys, which adds immensely to the danger, and is apt to be fatal from anuria (III, 57). Unfortunately, whether by reflex or other causes, when only one kidney is injured, occasionally the other kidney ceases to act, and anuria results just as if both kidneys had been originally injured, and is apt to be fatal.

In addition to this, it is to be observed that there are on record a number of cases in which, after nephrectomy, the patient necessarily died, since the other kidney was absent. One such case (9) appears in my Table III. Similar cases have also been recorded by Simon,¹ Bryant,² Taylor,³ besides the well-known case of Polk,⁴ whose patient lived for eleven days without any kidney. These, however, were not cases of rupture. Mr. Cox also⁵ has reported an early case of rupture of the only existing kidney of a patient, eighteen years of age, who died comatose eleven days after the injury, the kidney having been divided into two halves. The actual presence of the other kidney, therefore, should always be determined if operation is done by the abdominal route.

The rupture is, as a rule, transverse to the curved long axis of the kidney. This is owing to the peculiarity of development of the kidney, in several small portions (*renculi*), which in man coalesce to form the entire kidney. As a result of this the vessels and tubules run in the transverse direction above alluded to and resemble the "grain" of a piece of wood; the splitting or rupture of the kidney is parallel to their direction. Very rarely, indeed, is the rupture longitudinal.

The rupture may vary in degree as well as in extent. It may consist—

(1) Of a more or less extensive bruise without any distinct tear of the capsule or solution of continuity reaching the surface, though the renal tissue itself is more or less ruptured under the capsule.

(2) The rupture may be an actual tear of the capsule as well as the renal substance, involving only the renal substance.

(3) It may involve not only the renal substance, but the pelvis, so that the kidney may even be torn into distinct pieces.

(4) While in any bruise or tear the smaller vessels must be involved, but the larger ones often escape, occasionally not only are the main vessels torn, but the kidney may be entirely torn loose from them.

¹ *Chirurgie der Nieren.*

² *Guy's Hospital Reports*, 1861, VII, 43.

³ *British Medical Journal*, November 5, 1870.

⁴ *New York Medical Journal*, February 17, 1883.

⁵ *Transactions of Pathological Society, London*, 1, 93.

(5) In addition to this, the ureter may be not only torn in the pelvis, but may be entirely torn loose. And,

(6) The kidney may not only be ruptured, but pulpified. Along with such rupture of the kidney, even of minor degrees, the perinephric tissues themselves must be more or less lacerated.

(1) If the capsule is not torn, as, for instance, in the case of a bruise, or contusion, even if severe, the hæmorrhage is not apt to be very great. Gradually as the blood is poured out, the resistance will increase and tend spontaneously to arrest the hæmorrhage. If the laceration of the kidney extends into a calyx, then, of course, urine as well as blood will accumulate, and if not carried off by the ureter later a hydronephrosis may result. The experiments of Teichmann¹ on the dead body show that such distention of the capsule is possible in the cadaver, and, *a fortiori*, will occur more readily in the living. Even if the capsule be torn and the kidney deeply lacerated, if the perinephric tissues are not much disturbed, blood and urine will accumulate about the kidney, but under considerable counter-resistance, forming a pseudo-hydronephrosis. In these cases the urine will be small in amount, and the urea always markedly diminished down to 0.5 or even 0.1 per cent. This fact is valuable both as a means of diagnosis and also in connection with the treatment to be considered later. The condition is well illustrated in the most admirably studied case of Mr. Barker,² in which the ureter itself was torn.

Whether the peritoneum is torn or not, however, is a very much more important question than lesion of the capsule. Rupture of the peritoneum means that both blood and urine can escape into the peritoneal cavity. So far as the blood is concerned, there will be no pressure to resist extravasation, and, therefore, the hæmorrhage will be very free, and, if any considerable vessel is torn, may quickly be fatal. So far as the urine is concerned, fortunately, normal acid urine is not infective (see Thornton³), but if there be in the kidney itself or in the ureter

¹ Obalinski, Sammlung klinische Vorträge, No. 16, 1891, 103.

² Lancet, January 17, 1885.

³ Loc. cit.

any source of infection, then the escape of urine into the peritoneal cavity means, as a rule, a fatal peritonitis.

Rupture of the peritoneum in children is much more common than in adults for an anatomical reason. The perinephric fat is not developed until eight or ten years of age, and prior to the development of this fat, the peritoneum is in direct contact with the anterior surface of the kidney and closely adherent to it. If, therefore, a rupture involving the anterior surface takes place under ten years of age, the peritoneum will be ruptured and the mortality greatly increased. In the seventy-one cases collected by Maas, of seven under ten years of age, six died.

(2) There may be hæmorrhage into and around the kidney; and,

(3) Hæmorrhage by the ureter into the bladder.

The local hæmorrhage as distinguished from hæmaturia depends, of course, on the amount of the tear and the size of the vessels involved. If the capsule is intact, the hæmorrhage is, as a rule, but slight. If the capsule is torn so that the blood can escape into the perinephric tissues, still the hæmorrhage may be only moderate if the adhesions are strong and the perinephric tissues but little disturbed by the violence, though in III, 111, a tear of only two millimetres caused serious hæmorrhage. If, on the other hand, they are much disturbed, the blood may extend in the several directions already indicated and to a great and often a fatal amount. If a large amount of blood accumulates around the kidney, especially if the blood becomes infected, either through the urine or through infection by the circulation, perinephric abscess will certainly follow. Primary hæmorrhage may produce a fatal result within, say, forty-eight hours. In Maas's seventy-one cases, four died as a result of primary hæmorrhage, and to show that secondary hæmorrhage may be equally fatal, four died from this cause also. In my table (III) of 118 cases of rupture eleven cases died of shock and primary hæmorrhage, two of secondary hæmorrhage, and one of continuous hæmorrhage.

The third variety of hæmorrhage is that in which the blood escapes by the ureter. This important sign of rupture of the kidney, however, may be absent (III, 30, 33, 40, 69). In the seventy-one cases of Maas, there was no hæmaturia in six. The

reasons for this may be various. First, and perhaps most frequently, the blood may clot in the ureter and act as a plug. Not only, then, will there be an absence of blood in the urine, but as the blood from the injured kidney cannot escape into the bladder, the total amount of urine should be diminished for a time. If the clots are forced through the ureter into the bladder, their progress will be attended with distinct attacks of renal colic and the hæmorrhage will recur until a new clot forms,—provided this takes place. A second cause for the absence of hæmaturia is thrombosis of the vessels (III, 69). A third, is complete rupture of the ureter, either the ureter proper, or, the ureter and the kidney may be totally severed from each other at the pelvis itself. In these cases the urine must necessarily escape into the perinephric tissues, and no bloody urine will be passed.

A fourth cause, though one that would very rarely be observed, is that of stricture of the ureter. Newman refers to cases reported by Pye Smith,¹ Croft,² and Reginald Harrison (Lectures). The only case reported in my tables in which there was a prior stricture of the ureter in a case of rupture of the kidney is Charteris (Case 32), in which there was absence of hæmaturia. On the other hand, there may be hæmaturia after an injury which does not signify rupture of the kidney, as in the puzzling case reported by Newman,³ in a boy of fifteen, who, in falling, struck his side violently in the region of the kidney, but recovered after a few days without any bad symptoms, except a persistent hæmaturia. On examining into the boy's prior history, however, it was discovered that he had had hæmaturia before his accident, due to a pre-existing papilloma of the bladder.

As a rule, of course, the blood which passes into the bladder escapes readily in the form of bloody urine, but occasionally (three cases in Maas's seventy-one) clots form in the bladder. The importance of this and its treatment has already been considered. Sometimes hæmaturia may be absent immediately after the accident, but may appear later, even as late as eight days after the accident (III, 36, 39).

¹ Pathological Society Transactions, London, Vol. xxxiii.

² Clinical Society Transactions, London, Vol. xiv.

³ Loc. cit., p. 312.

The dangers of rupture of the kidney are either primary or secondary. Apart from the fatal anuria following such an anomaly as of the presence of a single kidney which may be injured, the primary danger is especially hæmorrhage. The secondary dangers may be embraced in a single word, infection, either of the perinephric tissues, in which a hæmatoma has formed, followed by abscess; or of the renal substance itself, either directly or through the bladder, an infection which may reach the other kidney and prove fatal even if nephrectomy has been done.

Hence, the treatment may be conveniently divided into the primary treatment,—that is, of the first two, three, or four days; and, secondly, the secondary treatment of the later stages. The moment that such a case is seen, the first consideration is, has the injury been sufficiently severe to demand immediate exploratory incision to arrest the hæmorrhage, and, at the same time, to determine whether the kidney is so injured that it must be removed? As a guide to determining this question, the hæmaturia is of secondary importance. The symptoms of intra-peritoneal hæmorrhage and the loin symptoms indicating an already large or rapidly increasing tumor, which must consist chiefly of blood, are the chief indications, as has been so forcibly pointed out by Morris.¹ Only in exceptional cases is the amount of blood lost by the bladder dangerous. Ordinarily it is valuable only as a symptom showing the fact of rupture of the kidney, but not as a symptom by which to decide on operating, and still less to decide on nephrectomy. Not, therefore, the visible loss of blood by the bladder, but the insidious and concealed and easily overlooked, but far more dangerous bleeding into the perinephric tissues, or into the peritoneal cavity, should receive the chief attention. If, then, a tumor form quickly in the lumbar region, a lumbar exploratory operation should be immediately made, and if the kidney be hopelessly destroyed, or the hæmorrhage such as to require ligation of the renal vessels, nephrectomy should be done at once. We must take the chances of the existence and integrity of the other kidney. If the kidney is only moderately lacerated, then disinfection and drainage are indicated or, possibly, a

¹ Clinical Journal, August 1, 1894.

partial nephrectomy. If the evidence points to intra-peritoneal hæmorrhage, or to serious injuries to other abdominal viscera, abdominal section should be done, combined with a lumbar incision, if necessary, for drainage, the kidney being treated as before. In all cases of abdominal section, the existence and, if possible, the condition of the other kidney are to be determined before deciding on nephrectomy. The other abdominal injuries are to be appropriately treated. The bladder should be examined, and if found intact, but filled with blood clots, they should be expressed by the hand.

If an immediate exploratory operation be not indicated, as in the majority of cases will be the case, then the treatment should consist of absolute rest with the simplest possible diet, no alcoholic drinks, ice to the region of the kidney, and such remedies as will most readily arrest the hæmorrhage. Of these, the best are ergotine, gallic acid, and the acetate of lead. The bowels should be opened preferably by enema to rid the colon of any large and hard fæcal masses, and then be kept at rest lest active peristalsis of the colon increase the danger of renewed hæmorrhage. Anuria may result from shock or from the laceration of the only existing kidney. If from shock, the kidneys will resume their function within twenty-four to forty-eight hours. If they do not, then a lumbar incision should be made in order to give egress to the urine, as the other kidney may be either absent or partially worthless.

The secondary treatment will either be a continuance of the primary expectant treatment, or if, after a few days, it is evident that a considerable amount of fluid (blood and urine) has accumulated in the retro-peritoneal space, an incision should be made in the lumbar region and the clots and urine removed, and if the kidney itself be hopelessly injured, it should be then excised. Such secondary nephrectomy, however, should not be postponed until septic complications have developed, but should be done, if possible, to anticipate and prevent them. If the catheter is required, the most strenuous antiseptic precautions should be used, lest infection be carried into the bladder and extend to the other kidney.

If the earlier indications have not been serious enough for

any incision, but later the evidence points to any infective process in the retro-peritoneal extravasation of blood or urine or both, a free incision should be made by the lumbar route and the best possible drainage obtained. In cases of traumatic hæmato-hydronephrosis, aspiration may be used either for preliminary investigation or occasionally, as a definite method of treatment, in which case it may be repeated (see Table V), and may possibly even lead to cure.

Whether nephrectomy shall be done or not, usually has to be determined as indicated, either within the first two or three days, or, indeed, within the first few hours, or else is postponed until a much later date, when it becomes a secondary instead of a primary operation. Bobroff¹ has advised to arrest the hæmorrhage by simple ligature of the renal vessels without nephrectomy, basing his conclusion on experimental grounds, which show that necrosis does not necessarily follow. I am not aware of any case in which this has been carried out in the human subject, and I should certainly not be disposed to recommend it. If the vessels are ligated, the kidney will probably not remain functional and is at least liable to necrosis or atrophy. In either case, it is better out of the body than in it.

If the nephrectomy, or even exploratory operation, be secondary rather than primary, the lumbar route is, as a general rule, the best, though there may be cases in which the abdominal would be the one preferred.

The results of nephrectomy in some respects can hardly be compared with the result in cases in which no operation has been done, since nephrectomy is only done in the most severe and threatening cases, and, naturally, the mortality of the lighter cases in which no one would ever dream of doing nephrectomy is relatively small. Many such cases probably are never even published.

The decision of the question whether at least an immediate exploratory incision should be made should lean, I think, at least in severe cases, towards the affirmative, since although any operation whatever, including, of course, the effect of the anæsthetic, is a serious one, yet as compared with the risks of allow-

¹ *Centralblatt für Chirurgie*, 1891, 721.

ing active hæmorrhage to go on, even into the retro-peritoneal tissues, and all the more if the peritoneal cavity be torn open, they cannot be compared. The results of the cases in Table III show this very conclusion.

The decision as to whether an exploratory operation and possibly nephrectomy should be done as a secondary procedure is much easier. Not only have we ample time to consider the question, which is not true of a primary operation, but the indications, especially of infection and suppuration, are clearer. The lumbar route should be chosen by preference in nearly all such cases and, of course, free drainage established.

Partial nephrectomy has only been done in two cases (Table IV), but the results are encouraging. It is in the line of two contradictory tendencies of modern surgery, both to radical interference in the way of exploration and yet conservatism in the preservation of parts of organs which heretofore have been totally removed. If a lesion, whether it be rupture, incised wound, or gunshot wound of the kidney, involves only one extremity of it, but that extremity is pretty thoroughly destroyed, the surgeon would always be justified in excising at least one-third of a kidney, and possibly somewhat more; arresting the hæmorrhage, partly by suture ligature passed through the tissues of the kidney, and then by suturing the edges of the wound. For this purpose the renal excision may be made of a wedge shape, so that the edges should resemble the flaps of an amputation.

The effect of nephrectomy upon the other kidney in increasing its size and its efficiency, was well shown in my own case (I, 4). At first the remaining kidney threatened to be unequal to the task, but by the second day its excretion of urine began to increase, and soon after it proved entirely equal to its double work. At the death of the patient (fifteenth day) it was found to be 50 per cent. larger than the other kidney. This result confirms the results of experiment in the lower animals of Simon and others.

CONCLUSIONS AND SUMMARY OF RESULTS OF 118 CASES OF RUPTURE OF THE KIDNEY.

The total number of cases of rupture of the kidney, in greater or less degree, which appear in my tables is 118. Of these, one

case (III, 21) was under treatment when reported, and the result, therefore, is not known. Of the 117 cases, 67 recovered and 50 died, a mortality of 42.7 per cent. From these, however, if we are to judge rightly of the mortality, the following seventeen deaths in which treatment was futile or impossible should be deducted:

The other kidney absent	1
Both kidneys injured	2
Found dead	2
Died of other injuries in addition to the renal injury	12
Total	<hr/> 17

This leaves a total of 100, of whom 67 recovered and 33 died, a mortality of 33 per cent. This, however, is more than the necessary mortality of this serious injury, provided it is properly treated. There were thirteen early deaths, in which no nephrectomy was done, of which eleven died from shock and hæmorrhage and two from peritonitis in addition. There were also ten late deaths without nephrectomy, of whom all died from septic causes, excepting two, who died, one from continuous and the other from secondary hæmorrhage. Had nephrectomy been done in these twenty-three cases, it is, I think, a fair presumption that ten of them would have recovered, which would reduce the mortality to 23 per cent.

One of the most important questions, therefore, in connection with the treatment is whether nephrectomy should be done or not, and the light cast upon this question by the statistics collected in my tables is very important. Eliminating the two cases of partial nephrectomy, which both recovered (Table IV), I find that there are twenty-two cases of nephrectomy with eight deaths, a mortality of 36.4 per cent.; that there were ninety-five cases in which no nephrectomy was done, with forty-two deaths, a mortality of 44.2 per cent. This shows a difference of 8 per cent. in favor of nephrectomy, though the operation is only done in the most serious cases. If, as just indicated, the thirteen cases of early death, in a number of which nephrectomy might have saved life, especially by checking hæmorrhage and of ten late deaths, in which early nephrectomy would have saved some of the patients from the suppuration and exhaustion following sepsis, the percentage of mortality after nephrectomy, if say ten of these had

recovered, would be 33.7 per cent. as against 44.2 per cent. without nephrectomy, a difference of percentages of one-fourth.

The value of nephrectomy, especially of early nephrectomy, as a life-saving operation is all the more evident when we remember that the large majority of the cases in which no operation was done were the slighter cases of injury. If, then, these less serious cases show a mortality so much greater than the graver ones in which nephrectomy was done, it is evident that operation in many of the ninety-five unoperated cases in which the lesion was of a serious character would have saved many lives.

I have endeavored also by making an analysis of the cases to determine whether primary or secondary nephrectomy and whether abdominal or lumbar nephrectomy is the safer. I find that there are five cases of primary nephrectomy with one death, a mortality of 20 per cent.; and thirteen cases of secondary nephrectomy with five deaths, a mortality of 38.5 per cent., showing that secondary nephrectomy is nearly twice as fatal as primary.

As to the route of the operation, there were three cases of abdominal nephrectomy, of which one died, a mortality of 33.3 per cent., and fourteen of lumbar nephrectomy, of which four died, a mortality of 28.6 per cent. The number, especially of abdominal nephrectomies, is, of course, too small from which to draw any rigid conclusion, but on the whole, as indicated in the body of my paper, lumbar nephrectomy is the more desirable operation. The causes of death are also very instructive. They may be tabulated as follows:

Primary hæmorrhage and shock	11
Continuous hæmorrhage	1
Secondary hæmorrhage	2
Injury of other organs	12
Found dead	2
Absence of the other kidney	1
Peritonitis	5
Coma	2
Pneumonia and empyema	1
Suppuration and exhaustion	10
Anuria	1
Nephritis	1
Uncertain	1
Total	50

If we group these under more general headings, it will be observed that if we exclude the injuries of other organs (12), those found dead (2), the case of one kidney (1), and the uncertain case (1), we have thirty-four cases left, and of these primary, continuous, and secondary hæmorrhage combined with shock, destroyed 14; suppuration, including peritonitis, destroyed 16; leaving coma, anuria, and nephritis responsible for only 4 deaths. These figures emphasize what I have already stated that the dangers of rupture of the kidney above everything else are hæmorrhage and sepsis. As already stated, a more frequent resort to primary nephrectomy would have avoided a number of deaths from both of these causes.

The duty of the surgeon then seems clear. Where the symptoms are threatening, especially if there be marked evidence of hæmorrhage or probable danger of sepsis, an exploratory operation should be done immediately. Whether nephrectomy should be done is to be determined by the conditions already stated. It is especially to be noticed that *the great mass of recoveries in rupture of the kidney are the slighter cases; the graver ones do not recover, unless an operation is done.* In any case, therefore, with severe or dangerous symptoms, the surgeon should lean towards exploration, and in severe laceration towards early nephrectomy. It will add little to the risk and will probably save a considerable proportion of lives.

A word only is necessary as to hydronephrosis and rupture of the ureter. There are six cases of pseudo-hydronephrosis (Table V), so called since it is outside of the pelvis of the kidney, of which five recovered; the single death being from inguinal abscess. In one case a nephrectomy was done, followed by recovery. In the other five either aspiration or tapping was resorted to, with four recoveries and one death.

The cases of ruptured ureter (Table VI), I can only mention; they are rather outside of the subject, though so closely allied to it as to make their tabulation pertinent. Both of them, it will be observed, required ultimate nephrectomy.

The following tables of 155 cases of wounds and injuries of the kidney were collected by George W. Spencer, M.D., Assistant Demonstrator of Surgery, Jefferson Medical College.

TABLE I.—GUNSHOT WOUNDS OF THE KIDNEY.

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
1	Godfrey, Brit. Med. Journ., Lond., 1884, I, 357.	Pistol-ball, close range.	Morphine	. . . .	D. Five days from peritonitis.	<i>Post Mortem</i> : Bullet-hole in the centre of kidney, also one in liver; kidney and intestines inflamed.
2	Hays, Brit. Med. Journ., Lond., 1886, I, 150.	Martini ball.	Ergot, tannic acid, opium.	. . . .	Recov.	Hæmaturia slight at first; 9 days after injury passed by urethra large quantities of blood; 16 days after injury urine clear.
3	Root, Amer. Lancet, Detroit, 1887, N. S. XI, 366.	No. 8 shot left lumbar and sacral regions.	Stimula'ts, morph., ergot, gallic acid.	. . . .	Recov.	Hæmaturia; albumen, 10 per cent.
4	Keen, Trans. Am. Surg. Asso., 1887, V, 193.	32-calibre pistol-ball.	. . . .	Primary nephrectomy by abdominal incision; drainage through loin.	Death 15th day from gangrene of bowel.	<i>Autopsy</i> : Ball passed through stomach, border of liver, and left kidney; large opening in ileum; wounded superior mesenteric artery and vein; 12th day, no peritonitis; 15th day, peritonitis from gangrene of bowel.
5	Vander Veer, Albany Med. Annals, 1888, IX, p. I.	32-calibre pistol-ball.	Ergot, anodynes, hot pack.	. . . .	Recov.	Bullet supposed to have lodged in connective tissue surrounding kidney; hæmaturia 4 days.
6	Willard, Trans. Am. Surg. Asso., 1888, VI, 516.	22 pistol-ball at close range.	. . . .	Primary nephrectomy; abdominal incision.	D. Fourth day; hæmorrhage; peritonitis.	<i>Autopsy</i> : Renal artery and vein cut; blood in urine and retroperitoneal space; ball lodged in wall of aorta.
7	Price, Med. and Surg. Rep., June, 1888.	32 pistol-ball.	. . . .	Primary nephrectomy.	Recov.	Complicated by injury to the liver and multiple abscesses in liver.
8	Mayo, Northwestern Lancet, St. Paul, 1895, XV, 51.	Rifle-ball, distance 1 foot.	. . . .	Abdominal sec.; wound packed for 10 days and drained through kidney and lumbar incision.	Recov.	Complicated by two perforations of intestines, wound of omentum, and perforation of pleural cavity; blood in urine and abdominal cavity; ragged hole through upper half of left kidney; bullet found in muscles of back.
9	Dalton, St. Louis Cour. of Med., Aug., 1890, 80.	Gunshot wound of right kidney, liver, and lung at 20 yards.	Expectant.	. . . .	Recov.	Shock, pain; pulse 135 to 140; respiration 30 to 50; hæmaturia 3 days; jaundice, pneumonia, extravasation of blood into pleural cavity; no resonance over liver; no evidence of abdominal hæmorrhage or intestinal perforation; highest temperature 103° F.
10	Dalton, St. Louis Cour. of Med., Aug., 1890, 80.	Gunshot wound of right kidney	Expectant.	. . . .	Recov.	Vomited, but no blood; pulse 100; respiration 23; hæmaturia; highest temperature 102° F.; no res-

TABLE I.—GUNSHOT WOUNDS OF THE KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
		and liver at 4 feet.				onance over liver; no evidence of abdominal hæmorrhage or intestinal perforation.
11	Tiffany, Med. News, Nov. 17, 1894, p. 546.	Small calibre rifle-ball, 20 feet.	. . . .	Lumbar wound first enlarged and then laparotomy.	Recov.	Spleen and kidney both perforated; spleen tissue ligated over free border and kidney tamponned to arrest hæmorrhage from both; bullet not found.
12	Seefisch, Centralbl. f. Chir., 1896, p. 138.	Revolver.	Expectant.	. . . .	Recov.	Hæmaturia; lumbar dullness; 12th day pus by urine and fever; no resulting fistula.
13	Parkes, Trans. Am. Surg. Asso., 1888, VI, 527.	Gunshot.	. . . .	Intestinal perforation closed; kidney not touched.	D. 24 hours; hæmorrhage.	Death from hæmorrhage from kidney, which did not bleed at time of operation; intestinal wound in good condition.
14	Weir, Trans. Am. Surg. Asso., 1888, VI, 529.	Gunshot.	. . . .	Abdomen opened, then closed as hæmorrhage was not into abdominal cavity.	D. From hæmorrhage of over a quart.	
15	Richardson (private letter).	32-calibre revolver in contact with body.	. . . .	Abdominal section 14 hours after wounding; immediate nephrectomy.	D. 44 hours after operation; acute nephritis of other kidney; only $\frac{3}{8}$ xxv urine after operation; no peritonitis.	Pain, vomiting, hæmaturia; belly evidently penetrated; right kidney perforated from hilum to convex border, cutting the renal vein; hæmorrhage behind pancreas and in transverse meso-colon; liver perforated; no other visceral wound.
16	Richardson (private letter).	32-calibre pistol-ball.	. . . .	Abdominal section; capsule of kidney opened by longitudinal and transverse incisions; both ends renal wound packed with gauze for 6 days.	Recov.	Hæmaturia, pain, restlessness, rigid abdomen; free peritoneal hæmorrhage; liver perforated; kidney perforated from near pelvis up and outward.

TABLE I.—GUNSHOT WOUNDS OF THE KIDNEY.—*Concluded.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
17	Von Bruns, in Wagner, Nieren Chir., p. 83.	Gunshot.	. . . .	Secondary lumbar nephrectomy; resection 12th rib.	Death.	Hæmaturia, urinary fistula; other kidney filled with abscesses.
18	Tiffany (private letter).	Gunshot from in front.	. . . .	Immediate laparoto'y, also lumbar incision; liver and kidney tamponned	D. eight days.	Peritonitis; extravasation of urine.
19	Tiffany (private letter).	Pistol-shot from in front.	. . . .	Laparoto'y spleen and kidney wounded; spleen sutured, kidney tamponned.	D. 48 hours.	Peritonitis.

TABLE II.—PUNCTURED WOUNDS OF KIDNEY.

1	Hamilton, quoted by Willard, Trans. Am. Surg. Asso., 1888, VI, 517.	Stabbed by knife; kidney exposed.	. . . .	Nephrectomy (Lumbar incision).	Recov.	Reference and details not given.
2	Villeneuve, Bull. et Mém. Soc. de Chir. de Paris, 1890, N. S. XVI, 811.	By knife.	. . . .	Incised abscess; secondary nephrectomy.	Recov.	Perinephric abscess formed.
3	Cheever, Report, Boston City Hospital, 1894, Fifth Series, Vol. III.	By a pair of shears.	Gallic acid, ergot, morphine.	Nephrectomy on 11th day, lumbar incision.	Recov.	Pain in neck of bladder and head of penis; hæmaturia; lacerated wound in kidney; anæmic infarction 2½ x 2 centimetres, also small infarctions.
4	Cartwright, Lancet, London, 1880, I, 403.	Stab-wound in a Chinaman.	Bird-dung and saliva.	Ligature applied and kidney removed.	Recov. In 2 wks.	Kidney protruded through loin wound and was in state of putrefaction when seen by author; patient smoked 2 pipefuls of opium during operation then walked away and returned in 2 weeks well.

TABLE II.—PUNCTURED WOUNDS OF KIDNEY.—*Concluded.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
5	Roberts, J. B., Verbal communication.	Stabbed with carving-knife.	. . . .	Exploratory incision; drainage with large tube seven inches long.	D. After a month.	<i>Autopsy</i> : Abscesses of liver and abdominal sepsis; no urine escaped from wound; urine in bladder was not bloody.
6	Sebileau, JI. de Méd. de Bordeaux, 1881-1882, XI, 17.	Stab-wound; knife.	Ice on belly; drained.	. . . .	D. Two days after accident; coma from suppression of urine.	Pain at seat of wound; prostration; urine normal; lower and outer portion of left kidney lacerated.
7	Gage (Wagner, Nieren Chir., p. 83).	Fell on scissors.	. . . .	Primary lumbar nephrectomy.	Recov.	Hæmaturia; tumor; kidney cut into hilum; wound of large renal artery.
8	Chambrelient, Gaz.-Hebd., Bordeaux, 1881, 726.	Fell on a pointed stick.	Ergotin; rest.	. . . .	Recov. In 2 wks.	Profuse hæmorrhage from wound; hæmaturia at line of injury; urine became clear day after accident; remained clear 4 days, then bloody and contained clots.

TABLE III.—RUPTURE OF KIDNEY.

1	Isham, Chicago Med. Journ. and Exam., 1882, XLV, 364.	Fell four feet, striking left side across wooden horse.	. . . .	Aspirated 3 iv blood and clots.	D. Four days after injury; peritonitis.	No desire to urinate; dullness over left renal region; urine, smoky-brown color a few hours after injury, soon cleared and remained so. <i>Autopsy</i> : Intestines distended with gas; peritonitis; 3 vi-x of purulent fluid behind peritoneum, in this fluid was found remnants of kidney smashed in three parts.
2	Hamel, British Med. Journ., 1893, I, p. 357.	Woman supposed to have been victim of an assault.	. . . .	. . . .	D. Speedily; hæmorrhage and shock.	Found alone and unconscious; had suffered from lead-poisoning. <i>Autopsy</i> : All organs normal except left kidney, which was lacerated nearly an inch in length through capsule into kidney substance; blood in surrounding tissue.
3	Hearn, W. J., Verbal communication.	Fell across iron bar striking side.	Rest; ice-bag to side; opium.	. . . .	Recov. In 2 wks.	Hæmaturia for 4 days; intense pain over renal region.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
4	Newman, Surg. Diseases of the Kidney, p. 88.	Fell 36 feet, struck first on feet then on buttock.	Medicinal.	. . . .	Death 5th day; peritonitis.	Complicated by dislocation of right hip; no blood in urine a few hours after injury; six hours afterwards he passed by urethra a clot supposed to have come from ureter; dull pain in renal region <i>Autopsy:</i> Transverse rupture.
5	Macewen, Case 24, Newman, Surg. Diseases of the Kidney, p. 345.	Not given.	. . . .	Lumbar nephrectomy 4th week.	Death 8 hours after operation; shock.	Hæmaturia at intervals for 1 month after injury; Insensible and almost in articulo mortis when operation done.
6	Briddon, ANALS OF SURGERY, 1894, XIX, 643.	Slipped on ice; struck side on log.	. . . .	Lumbar incision; disinfecting with peroxide hydrogen; irrigated.	Recov. After 47 days.	Through the incision large amounts of extremely fetid bloody urine escaped; through incision only a small portion of kidney could be detected; the rest was broken down, hanging in shreddy masses and not removed.
7	Briddon, ANALS OF SURGERY, 1894, XIX, p. 644.	Knocked down and run over by two-wheeled wagon.	Rest; ice to loin; irrigated bladder.	. . . .	Recov. After 25 days.	Blood in urine a few minutes after injury, which continued at intervals for a few hours, then ceased; bladder irrigated later, urine clear.
8	Johnson, Montreal Med. Journ., 1893-1894, XII, 624.	Patient found dead.	. . . .	. . . .	Death, shock, and hæmorrhage; found dead.	No serious external injuries. <i>Autopsy:</i> Kidney ruptured.
9	Johnson, Montreal Med. Journ., 1893-1894, XII, 624.	Beam fell across loin.	. . . .	. . . .	Death, shock, and hæmorrhage; other kidney absent.	Dulness extended from right flank to umbilicus; urine contained blood. <i>Autopsy:</i> Injured kidney large; the other kidney not present, though its ureter could be traced a little ways from the bladder.
10	Briddon, ANALS OF SURGERY, 1894, XIX, p. 641.	Fell 16 feet from scaffold, striking on hands and left side.	. . . .	Lumbar incision; blood-clots and sero-pus escaped; irrigated with 10 per cent. creoline solution.	Recov. In 29 dys.	Blood in urine soon after accident; tumor in left loin and hypochondrium; through the incision a rent in kidney could be seen.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
11	Briddon, AN- NALS OF SURGERY 1894, XIX, p. 642.	Fell into a sewer alight- ing on right side.	. . . .	Explora- tory lum- bar inci- sion.	Recov. In 59 dys.	Worked for 2 weeks after accident; at times had pain over right kidney and urine was dark-red in color; through the incision a deep rent, 1½ inches in length could be seen on posterior surface of kid- ney; clear urine escaped through the incision.
12	Chuckerbutty, Annals of Universal Medical Sciences, 1889, Vol. III, p. 55.	Fell over the lower piece of door- frame; injured left loin.	Turpen- tine and buchu.	Incision into tu- mor; 3 viii of blood- clots re- moved by fin- gers; irrigated with bi- chloride; drained.	Recov.	Blood in urine 1 hour after accident, remained so for 10 days; tumor formed over left loin.
13	West, Lancet, 1883, 1, 424.	. . . .	. . . .	Primary aspiration, later ne- phrec- tomy.	Recov.	Suppuration ensued before aspiration; kidney large, full of suppurating cysts.
14	Campbell, Edinburgh, Med. Journ., 1890-1891, XXXVI, 735- 737.	Blow from breaking of a tight rope.	Opium, fomenta- tions, leeches.	. . . .	D. Sixth day; coma.	Passed large quantities of blood by urethra day fol- lowing accident. <i>Autopsy:</i> Kidney had a deep gash; moderate lac- eration of liver.
15	Campbell, Edinburgh, Med. Journ., 1890-1891, XXXVI, 735- 737.	Struck in the side by a large beam.	Opium.	. . . .	D. Fifth day; hæmor- rhage.	Walked 100 yards; pure blood drawn from bladder soon after accident. <i>Autopsy</i> could not be ob- tained.
16	Mynter, AN- NALS OF SURGERY, 1891, XIV, 120.	Caught obliquely between bumpers while coupling cars.	. . . .	Incision in groin; removed coagu- lated blood; disin- fected; packed with iodoform gauze.	Recov.	Through the incision could be seen a badly mashed portion of the kidney.
17	Tuffier, Bull. et Mém. Soc. de Chir. de Paris, 1894, N. S., xx, 289.	Fell from scaffold.	. . . .	Lumbar incision; sutured wound in kidney.	Recov.	Perinephric hæmorrhage.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
18	Fenger, Journ. of the Am. Med. Asso., Chicago, 1889, XII, 901.	Fell five feet.	. . . .	Lumbar drainage and later nephrectomy.	D. 3 weeks after nephrectomy; pneumonia.	<i>Autopsy:</i> Abscess of remaining kidney and of liver which communicated through an opening in the diaphragm with an empyæma discharging through lung.
19	Power, Trans. of the Path. Soc., London, 1889-1890, XLI, p. 161.	Fell 26 feet.	Medicinal.	. . . .	D. 18th day; fractured skull.	<i>Autopsy:</i> Kidney lacerated from hilum for an inch and a half into cortex; fractured skull and ribs; blood in urine for 3 days after accident.
20	Gay, Report, City Hosp., Boston, 1889, 4th S, 218.	Fell striking left loin on a water-pail.	Medicinal.	. . . .	D. 2 months after injury; exhaustion; peritonitis.	Blood in urine soon after accident. <i>Autopsy:</i> Lower part of left kidney disappeared; author says if kidney had been taken out the result would have been different.
21	McBurney, Times and Reg., Philadelphia, 1889, Vol. XX, p. 772.	Fell from window 40 feet.	. . . .	Abscess opened and drained; later exploratory incisions and drainage.	Under treatment.	Highly stinking ammoniacal pus escaped from 1st incision; through the 2d incision a cleft in the kidney could be felt which was covered with granulations; patient just operated on, was still in bed.
22	Reeves, Lancet, 1884, II, 588.	Fell from cart.	Turpentine; subcutaneous injections of sclerotic acid.	. . . .	D. 1 month after injury.	Twenty ounces pure blood by urethra 10 days after injury; blood in urine until death. <i>Autopsy:</i> Kidney substance formed a broken down pulp; false aneurism of a branch of renal artery.
23	Spence, Med. Times and Gaz., London, 1885, I, 9.	Struck on right side, knocked down a cutting 16 feet deep.	Ice-bag to loin; iron.	. . . .	D. 47th day; exhaustion.	Large quantities of blood in urine next day after injury. <i>Autopsy:</i> Rupture was found in the medullary substance at upper part of right kidney.
24	Campbell, Liverpool Med. Chir. Journ., 1887, VII, 225.	Run over by a fire-engine.	Stimulants, restoratives.	Suprapubic cystotomy, the diagnosis being rupture of bladder.	D. 24 hours after injury; hæmorrhage.	<i>Autopsy:</i> Left kidney completely divided; abdomen full of blood.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
25	Preston, Maryland Med. Journ., Balt., 1887-1888, XVIII, 151.	Fell from ladder.	Morphine, rest.	. . . .	Recov.	Pain over right kidney; vomiting; collapse; passed 16 ounces of bloody urine next day after injury; 3d day urine clear.
26	Stoker, Dublin Journ. of the Med. Sci., 1880, 3d S., LXIX, 61.	Crushed between buffers of two railway wagons.	Opium, calomel, rest.	. . . .	Death 4th day; hæmorrhage and shock.	Walked after injury; no blood in urine; jaundice. <i>Autopsy:</i> Liver lacerated; right kidney torn.
27	Randon, Med. Chir. Trans., 1882-1883, N. S. I, 137.	Fell into a basement 8 feet.	. . . .	Lumbar nephrectomy, 17th day.	Death 14th day; Suppuration; pyelitis.	Complicated by acute cystitis, for which later cystotomy was performed. <i>Autopsy:</i> Complete rupture; suppurative pyelitis of other kidney.
28	Bennett, Dublin Journ. of Med. Sci., 1880, LXX, 164.	Fell short distance from ladder.	Restoratives, warmth.	. . . .	Death 11 wks. after accident; peritonitis; both kidneys injured.	Complicated by fractures of radius, humerus, and index finger; large quantities of blood in urine. <i>Autopsy:</i> Peritonitis; abscess of both kidneys; cicatrix in left kidney; evidence of traumatism in right kidney.
29	Davy, Cincinnati Lancet Clinic, 1879, N. S. III, 409.	Fell into cellar.	Dover's powder, wet cups, quinine.	. . . .	Recov.	Several hours after accident passed 3 pints of bloody urine, probably one-third blood; no blood in urine after second day.
30	Judkins, Cincinnati Lancet Clinic, 1879, N. S. III, 409.	Fell two feet from a plank while pushing a wheelbarrow, struck right side.	Warm applications, opiates.	. . . .	Death 40 hours after accident; hæmorrhage.	Shortly after accident no urine or blood in bladder; walked 2 miles. <i>Autopsy:</i> Right kidney damaged beyond recognition; extensive hæmorrhage.
31	Anders, quoted in Brit. Med. Journ., 1879, II, 618.	Fell from 2d story of house, feet first, then fell on side.	Ice-bag to abdomen and lumbar region, morphine.	. . . .	Death 48 days after accident; hæmorrhage.	Blood in urine; ceased shortly after accident. <i>Autopsy:</i> Large clot size child's head in abdominal cavity; kidney in two halves found embedded in the clot; ureter, artery, and vein ruptured; no other organ injured.
32	Charteris, Lancet, 1880, I, 1890.	Fell against corner of table striking right side.	Icc, effervescing draughts, morphine.	. . . .	Death 30 days after injury; exhaustion from vomiting.	No blood in urine; ureter impervious; vomiting prominent symptom. <i>Autopsy:</i> Right kidney ruptured completely; no rupture of peritoneum; perinephric abscess; 3 xvi pus.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
33	Dunlap, Lancet, 1880, I, 91.	Thrown against iron railing.	. . . .	. . . .	D. Shock, hæmorrhage; found dead.	No blood in bladder; was seen intoxicated six hours before he was found. <i>Autopsy:</i> Kidney very much lacerated throughout its entire extent.
34	Dunlap, Lancet, 1880, I, 91.	Kick in side.	Restoratives.	. . . .	D. 60 hours after injury; hæmorrhage and peritonitis. Recov.	Walked one mile after injury. <i>Autopsy:</i> Acute peritonitis; left kidney torn almost completely through at hilum; blood in peritoneal cavity.
35	Cuskery, Maryland Med. Journ., 1880, VII, 318.	Fell into cellar, 13 feet.	Stimulants, rest.	. . . .	Recov.	Pain over kidney; blood immediately after injury; urine clear in 3 days; complicated by fracture of last two ribs right side; dislocation of right clavicle.
36	Cuskery, Maryland Med. Journ., 1880, VII, 319.	Fell 35 ft. together with beams and planks.	Rest.	. . . .	Recov. 68 days.	No urine passed for the first 28 hours; at expiration of this time only $\frac{1}{2}$ pint of clear urine was found in bladder; from this time until the 68th day blood was seen in urine.
37	Conolly, Maryland Med. Journ., 1880, VII, 319.	Kicked by mule over left kidney.	Symptomatic.	. . . .	D. 2 yrs. and 4 mos. after injury; perinephric abscess.	Blood disappeared entirely on 10th day. <i>Autopsy:</i> Left kidney atrophied; right kidney hypertrophied; perinephric abscess of left kidney, which had perforated colon.
38	Dumarest, Lyon Méd., 1880, xxxv, 565-7.	Fell 36 ft. striking side.	Ergotin, opium, quinine, morphine.	. . . .	Death 20 days after accident.	<i>Post Mortem:</i> Right kidney swollen and contained pus.
39	Burrow, Med. Press and Circular, London, 1890, N.S., I, 572.	Fell down stairs, struck side against pail.	Ice, quinine, brandy.	Incision; $\frac{3}{4}$ iv pus escaped.	Recov.	Blood appeared in urine 8 days after injury; remained 7 days.
40	Lupton, Lancet, 1882, II, 566.	Wheel of lumber wagon passed over pelvis and abdomen.	Hot applications, ice by mouth, brandy.	. . . .	D. 3 days after injury.	No desire to urinate; catheter would not pass (obstructed) scrotal swelling; (no urine by aspiration); no coma, no peritonitis. <i>Autopsy:</i> Separation of pubic bones at symphysis; no urine in abdominal cavity; fundus of bladder destroyed; prostate crushed; right kidney deeply bruised; capsule crushed and lacerated.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
41	Weir, New York Med. Journ., 1887, XLV, 314.	Fell 6 or 8 feet, striking right side on iron bar.	Medicinal.	Perinephric abscess, operated on 3 yrs. after injury; also renal fistula; large amount of pus.	Death 24 hours after operation for renal fistula; vomiting and almost complete suppression of urine.	<i>Post Mortem</i> : Kidneys destroyed; urine discharged daily, \bar{z} 50-60; acute suppurating interstitial nephritis of left kidney.
42	Hamilton, Brit. Med. Journ., 1890, II, 629.	Kicked in loin by horse.	Iron, gallic acid, opium.	. . . .	Recov.	Three ounces almost pure blood drawn from bladder at time of accident gradually became less; went to work in 16 days.
43	Mudd, Trans. Am. Surg. Asso., 1888, VI, 517.	Carriage-wheel passed over abdomen.	. . . .	Nephrotomy 26th day; lumbar nephrectomy 51st day.	Recov.	Kidney lacerated; numerous hæmorrhagic infarctions.
44	Keen, not published.	Fell over a cellar door, struck loin.	Rest 4 days.	. . . .	Recov.	Blood in urine 2 days.
45	Dunlap, Lancet, 1880, I, 91.	Struck in side by sack of flour.	Restoratives for shock.	. . . .	Death 2 hours after accident; shock, hæmorrhage.	<i>Autopsy</i> : Left kidney badly lacerated; hæmorrhage in peritoneal cavity.
46	Frazer, Med. Press and Circular, London, 1878, N.S. XXVI, 200.	Squeezed between tire and driving chain of a mill-wheel.	Opium, fomentations.	. . . .	Recov. after 22 days.	Complicated by laceration of the left lobe of liver; peritonitis and jaundice 2 days after injury; hæmaturia for 5 days.
47	Eastman, St. Louis Cour. of Med., 1880, IV, 237.	Fell from horse.	Opium, ice, brandy.	. . . .	D. Peritonitis, uræmia, 22 days after accident.	Walked one-half mile after injury; hæmaturia off and on until death. <i>Autopsy</i> : Peritonitis; left kidney badly lacerated.
48	Roberts, Lancet, 1884, I, 698.	Fell while intoxicated from the 7th story of house.	Medicinal.	. . . .	D. 8th day.	Complicated by fracture of skull; urine bloody at time of injury; clear 3d day. <i>Autopsy</i> : Right kidney lacerated in two places transversely.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
49	Campbell, Brit. Med. Journ., 1884, I, 225.	Leaped over hedge, landing on his feet at a lower level than expected, then fell on left side.	Ice.	. . . .	Recov.	Suffered with albumen in urine following a fever before accident; hæmaturia at time of accident; well on tenth day.
50	Keen, unpublished.	Fell through elevator shaft from 3d floor.	Rest, opium.	. . . .	Recov. in 2 wks.	Hæmaturia for 5 days; complicated by fracture of os calcis and nocturnal epilepsy.
51	Weir, New York Med. Journ., March 30, 1889.	Fell 20 ft.	. . . .	Abdominal nephrectomy; splenectomy.	Death. 9 hours after operation.	Abdominal cavity contained over a pint of blood; after kidney was taken out it was found that bleeding continued from the spleen, which also was deeply lacerated; kidney dislocated downward was held only by its artery; veins were lacerated; spleen removed.
52	Grawitz, Arch. klin. Chir., XXXVIII, 421.	Fell 6 ft. on edge of chest.	. . . .	. . . .	D. 24 hours.	Hæmaturia; right kidney, artery, and vein torn; great quantity of blood in peritoneum.
53	Grawitz, Arch. klin. Chir., XXXVIII, 421.	Fell while running.	Rest, ice, opium.	. . . .	Recov.	Great pain; retention of urine 4 days, then immense quantity of bloody urine voided; hæmaturia 5 weeks.
54	Obalinski, Sammlung klin. Vort., N. F., No. 16, March, 1891.	Fell from horse.	. . . .	Lumbar nephrectomy 32d day after injury.	Recov.	Shock; intermittent hæmaturia; on 9th day tumor in hypochondrium; kidney torn in two.
55	Kehr, Deut. Zeit. Chir., 1894, XXXIX, 402.	Fell from ladder on iron beam and then to cellar.	. . . .	Immediate abdominal nephrectomy.	Recov.	Hæmaturia, great shock, dulness, and tumor of entire left belly; ruptured pelvis of kidney.
56	Arx (quoted by Kehr).	Fell on corner of stone from height.	. . . .	Lumbar nephrectomy 15th day.	Death 24 hours after operation; secondary hæmorrhage.	Hæmaturia 10 days; 15th day secondary hæmorrhage.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
57	Sonnenburg (quoted by Kehr).	. . . .	. . . .	Nephrectomy.	Death. Anuria; both kidneys ruptured.	Unilateral hæmorrhage from ruptured kidney; remaining kidney also ruptured.
58	Lorge, Centralbl. Chir., 1892, p. 86.	Crush.	. . . .	Lumbar nephrectomy 3d day.	Recov.	Severe hæmaturia.
59	Studsgaard, Wagner, Nieren Chir., p. 77.	Run over.	. . . .	Lumbar nephrectomy.	"	Hæmaturia; kidney crushed.
60	Wagner, Deut. Zeit. Chir., 1892, xxxiv, 110.	Run over.	Medicinal.	. . . .	"	Hæmorrhage in lumbar region; pneumonia.
61	Wagner, Deut. Zeit. Chir., 1892, xxxiv, 110.	Run over.	"	. . . .	"	Hæmaturia 4 days.
62	Wagner, Deut. Zeit. Chir., 1892, xxxiv, 110.	Fall from 2d story.	"	. . . .	"	Marked hæmaturia.
63	Wagner, Deut. Zeit. Chir., 1892, xxxiv, 110.	Fell 10 feet.	"	. . . .	"	Hæmaturia.
64	Wagner, Deut. Zeit. Chir., 1892, xxxiv, 110.	Fell from roof.	"	. . . .	"	Hæmaturia 6 days.
65	Wagner, Deut. Zeit. Chir., 1892, xxxiv, 110.	Fell from wagon.	"	. . . .	"	Hæmaturia.
66	Wagner, Deut. Zeit. Chir., 1892, xxxiv, 110.	Caught between railway buffers.	"	. . . .	"	Hæmato-thorax, pneumonia, hæmaturia.
67	Wagner, Deut. Zeit. Chir., 1882, xxxiv, 110.	Fell two stories.	"	. . . .	"	Hæmaturia.
68	Wagner, Deut. Zeit. Chir., 1892, xxxiv, 110.	Run over.	"	. . . .	Death. 10 hours; shock and hæmorrhage.	Great shock; few drops of bloody urine; blood in peritoneum.
69	Wagner, Deut. Zeit. Chir., 1892, xxxiv, 110.	Fell two stories.	"	. . . .	Death. 7th day; from fractured skull, etc.	Fractured skull; meningitis; peritonitis; rupture liver and kidney; necrosis kidney; no hæmaturia; vessels thrombosed.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
70	Wagner, Deut. Zeit. Chir., 1892, xxxiv, 110.	Run over.	Medicinal.	. . . .	Death. Coma.	Hæmaturia; rupture of liver and kidney and necrosis of latter; multiple fracture of ribs; blood in peritoneum.
71	Neuber Döge (quoted by Wagner).	. . . .	. . . .	Nephrectomy.	Death.	Ruptured kidney; suppuration; cystotomy.
72	Demme (quoted by Wagner).	. . . .	. . . .	Nephrectomy.	Recov.	Perinephric abscess; injury of lung.
73	Leith, Edinburgh Med. Journ., Oct., 1895, 358.	Tree fell on him.	. . . .	. . . .	D.	Other injuries; kidney ruptured.
74	Kosinski, J., Centralbl. Chir., 1892, 127.	Fell 9 feet.	. . . .	Lumbar nephrectomy in 7th week.	Recov.	Walked to his home; hæmaturia 7 weeks; 12th rib resected; kidney in 3 pieces
75	Hochenegg, Wiener klin. Woch., 1891, 61.	Fell 5 feet.	. . . .	Abdominal nephrectomy 14th day.	"	Hæmaturia; retroperitoneal hæmorrhage from nipple line to ilium; fever; chills; kidney ruptured.
76	Bobroff, Centralbl. Chir., 1892, 722.	Contusion of right side.	. . . .	Lumbar nephrectomy 13th day.	"	Hæmaturia; renal tumor; pelvis of kidney ruptured.
77	Englisch, Wien. Med. Presse, 1878, 558.	Contusion of kidney from kick of horse.	Medicinal.	. . . .	D.	Nephritis; microscopic hæmaturia; kidney contused.
78	Englisch, Wien. Med. Presse, 1878, 597.	Contusion of kidney between wagon and bank of earth.	Ice, calcium phosphate.	. . . .	Recov.	Hæmaturia; tumor from ribs to ilium; fracture of 10th and 11th ribs.
79	Englisch, Wien. Med. Presse, 1878, 598.	Fall from horse; contusion right kidney.	Calcium phosphate	. . . .	"	Hæmaturia.
80	Kade, St. Peters Med. Woch., 1881, vi, 51.	Squeeze of the right side in a boy aged 16 years.	. . . .	. . . .	Death.	Contusion and displacement of the kidney.
81	Grawitz, Arch. für klin. Chir., 1888, 420.	Horse-kick in renal region.	. . . .	. . . .	Recov.	Hæmaturia and pain in renal region.
82	Grawitz, Arch. für klin. Chir., 1888, 420.	Fall from horse.	. . . .	. . . .	"	Hæmaturia; great pain in renal region.
83	Grawitz, Arch. für klin. Chir., 1888, 420.	Fall from building.	. . . .	. . . .	"	Hæmaturia; pain in renal region.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
84	Grawitz, Arch. für klin. Chir., 1888, 420.	Fall from building.	. . . .	. . . .	Death same day.	Complete tear right kidney.
85	Tuffier and Levi, Ann. des Malad. des Org. Genito-Urin., 1895, No. 3.	Contusion.	. . . .	. . . .	Recov.	Swelling of right renal region; hæmaturia 5 to 6 dys.; sudden discharge through bladder of bloody urine, with diminution of lumbar swelling on 11th and 12th day, with bloody urine for 8 to 14 days.
86	Tuffier and Levi, Ann. des Malad. des Org. Genito-Urin., 1895, No. 3.	Contusion.	. . . .	. . . .	"	Swelling of right renal region; hæmaturia 5 to 6 dys.; sudden discharge through bladder of bloody urine, with diminution of lumbar swelling on 11th and 12th day, with bloody urine for 8 to 14 days.
87	Tuffier, Bull. et Mém. Soc. de Chir., Paris, xx, 317.	Struck by terra-cotta pipe falling seven stories.	. . . .	Lumbar incision; suture of renal wound; drainage; resection; transverse processes lumbar vertebræ.	Recov.	Enormous lumbar swelling; kidney ruptured; fracture; first and second lumbar transverse processes.
88	Tuffier, Bull. et Mém. Soc. de Chir., Paris, xx, 320.	Caught between horse and wagon.	Expectant.	. . . .	Recov.	Fracture of 11th rib; hæmaturia 4 days.
89	Tuffier, Bull. et Mém. Soc. de Chir., Paris, xx, 320.	Kicked by horse.	Expectant.	. . . .	Recov.	Hæmaturia 2 days.
90	Tuffier, Bull. et Mém. Soc. de Chir., Paris, xx, 321.	Caught between two wagons.	Expectant.	. . . .	Recov.	Fracture of 11th and 12th ribs; hæmaturia 11 days; recurrence for 3 days.
91	Tuffier, Bull. et Mém. Soc. de Chir., Paris, xx, 322.	Fell three stories.	Expectant.	. . . .	Recov.	Hæmaturia 1 day.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
92	Peyrant, Bull. et Mém. Soc. de Chir., Paris, xxv, 289.	Fell several feet.	. . . .	Lumbar nephrectomy 63d day.	Recov.	Slight hæmaturia; partial recovery after 5 or 6 wks.; then lumbar tumor from 6th rib to ileum.
93	Girard-Marchant, Bull. et Mém. Soc. de Chir., Paris, xx, 292.	Knocked down by wagon.	. . . .	Lumbar nephrectomy 5th day.	Recov.	Temporary hæmaturia; extravasation to penis and testicle; lumbar tumor; kidney torn in two.
94	Jäckel, Deut. militär Zeit., 1890, Heft 11, 714.	Severe blow in left renal region; rupture of kidney.	. . . .	. . . .	Recov.	Hæmaturia.
95	Schroeder, Münch. Med. Woch., 1895, No. 32.	Fall on back.	. . . .	Incision; drainage.	Recov.	Hæmaturia; lumbar swelling; fever; delirium; upper third of kidney almost wholly torn loose.
96	Marshall, Med. Chir. Trs., 1883, LXVI, 311.	Wheel of cart passed over abdomen.	. . . .	Puncture.	Recov.	Nine months after injury $\frac{3}{4}$ xli of yellow-brown fluid evacuated; temperature before aspiration 103.2° F.; after aspiration normal; no hæmaturia.
97	Ryan, Australian Med. Journ., 1889, N. S., xi, 371.	Thrown from horse; fell on right side.	. . . .	Aspiration; later incision into tumor; drained.	Recov.	Hæmaturia 2 days; lumbar tumor aspirated f $\frac{3}{4}$ clxx; straw-colored fluid; from later incision f $\frac{3}{4}$ cc. escaped.
98	Sebileau, Journ. de Méd., Bordeaux, 1881-82, xi, 18.	Wheel of a refinery.	. . . .	Amputation of thigh.	D. 10 hours.	Blood in urine 2 hours after accident. <i>Autopsy</i> : Perinephric hæmorrhage; right kidney lacerated near pelvis; condition of thigh required amputation.
99	Sebileau, Journ. de Méd., Bordeaux, 1881-82, xi, 18.	Fall.	Rest.	. . . .	Recov.	Large amount of blood in urine for five days after accident, then became clear and remained so; fracture of right leg.
100	Pierez, Leward Islands Med. Journ., 1891, 168.	Run over by cart.	Antipy-rine, ergot, digitalis, potassium, bromide.	. . . .	Recov.	A pint of bloody urine drawn 24 hours after accident.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
101	Morris, Clin. Journ., London, 1894, IV, 219.	Omnibus passed over abdomen.	Opium ; brandy.	. . . .	D. 13 hours after injury ; hæmorrhage and complications.	Urine contained large quantities of blood. <i>Autopsy:</i> 8, 9, 11, 12 ribs fractured; right lung penetrated by two ribs; peritoneal cavity contained 3xii blood, came from ruptured mesenteric artery; right pleura contained 3viii blood; left pleura contained 3iv blood; both suprarenals crushed; upper part right kidney torn across in oblique direction, both kidneys surrounded by large blood clot; liver and spleen torn.
102	Morris, Clin. Journ., London, 1894, IV, 220.	Fall from a van, wheel struck him in right side.	. . . .	Incision into tumor; drainage (twice); 3d incision; kidney could not be recognized.	Recov. Urinary fistula 7 years.	No blood in urine; passed blood by rectum for few days after injury; tumor developed on right side of abdomen twice; incision into first tumor 2 months after injury (urine and blood); also detected rent in pelvis of kidney; 2 years and 10 mos. after injury for cure of the sinus commenced a nephrectomy; but the kidney could not be recognized.
103	Morris, Clin. Journ., London, 1894, IV, 221.	Probably received an injury while intoxicated.	. . . .	Secondary lumbar nephrectomy; 3½-4 lbs. of blood; clots removed.	Recov.	Small amount of blood in urine at beginning of his illness; laceration about size of a 5-shilling piece on front aspect of lower half of kidney, from anterior margin nearly to the posterior, and from lower edge of hilum nearly to lower extremity.
104	Péan, Bro-deur Thèse de Paris, p. 231.	Contusion right kidney.	. . . .	Secondary lumbar puncture.	Death.	Perinephric abscess.
105	Boiffin, Gaz. Méd. de Nantes, 11-12, 1892-94, 62.	Fell from wagon, struck right flank.	Leeches, mustard, ice, morphine.	. . . .	Recov. in 8 days.	Large amount of blood and clots in urine; nephritic colic; urine clear after third day.
106	Guillet, Journ. de Méd. de l'Ouest, 1882, XVI, 231.	Fell from ladder 2 metres, struck on head and left side.	Leeches, mustard, tonics, rest.	. . . .	Recov. in 3 wks.	Shock; hæmaturia for 18 days; renal colic.

TABLE III.—RUPTURE OF KIDNEY.—*Continued.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
107	Poireault, De la Contusion du Rein, Thèse de Paris, 1882, 45.	Fell from scaffold, struck right side.	Ergotine, quinine, opium, morphine.	. . . .	Latc death; pyonephrosis.	Intense hæmaturia; large clots formed in bladder were broken up with sound; after a time blood disappeared from urine; reappeared on the 23d day; septic symptoms on the 50th day after accident. <i>Autopsy:</i> Right kidney inflamed; left kidney purulent.
108	Poireault, De la Contusion du Rein, Thèse de Paris, 1882, 42.	Fall.	Rest, milk, diet.	. . . .	Recov. in 2 days.	Immediate hæmaturia; urine normal in 2 days.
109	Poireault, De la Contusion du Rein, Thèse de Paris, 1882, 39.	Blow.	. . . .	. . . .	Death 14 days after injury; peritonitis.	Urine very bloody for 3 days; by 10th day clear; on 10th day had severe pains and chills followed by vomiting. <i>Autopsy:</i> Peritonitis; right kidney lacerated transversely into two portions widely separated.
110	Gargam, A., De la Contusion du Rein, Thèse de Paris, 1881, p. 52.	Fall upon pavement.	. . . .	. . . .	Recov. 3 months.	Immediate hæmaturia 7 days after accident began to decrease.
111	Gargam, A., De la Contusion du Rein, Thèse de Paris, 1881, p. 55.	Struck by falling boiler.	Opium, atropine, rest.	. . . .	Death 2 days after accident; shock; hæmorrhage; other injuries.	Great abdominal pain; fracture of pelvis and bones of hand; day after accident retention, when drawn, urine contained blood. <i>Autopsy:</i> Right kidney in a mass of clotted blood; fissure 2 millimetres in length; left kidney in a bloody infiltration.
112	Gargam, A., De la Contusion du Rein, Thèse de Paris, 1881, p. 89.	Fell, striking anterior abdominal wall.	. . . .	Aspirated.	D. 48 hours after accident; hæmorrhage and peritonitis.	Internal hæmorrhage followed by symptoms of peritonitis. <i>Autopsy:</i> Large cyst on anterior surface of kidney, containing large amount of blood clots; laceration of interior of kidney which communicated with cyst.

TABLE III.—RUPTURE OF KIDNEY.—*Concluded.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
113	Ripole, Rev. Méd. de Toulouse, 1885, XIX, 449.	Blow in left flank while boxing.	Rest, ice, lemon juice.	. . . .	Recov. In 4 wks.	Abundant hæmaturia immediately; left testicle retracted; 4 days after injury large mass appeared in left lumbar region, extended to base of thorax; suppression of urine; 5th day tumor disappeared, urine became clear and abundant.
114	Havoge, Progrès Méd., 1881, IX, 44.	Crushed by wagon against lamp-post.	. . . .	. . . .	D. In 9 hrs.; shock; hæmorrhage.	<i>Autopsy:</i> Complete rupture kidney; laceration of spleen.
115	Gaudin, Marseille Méd., 1886, XXIII, 681.	Jumped out of window.	. . . .	. . . .	Instant death; fracture of skull.	Fractured skull; laceration of kidney, spleen, and liver.
116	Blum, Arch. Gén., 1894, II, 467.	Fell from omnibus, struck shoulder and left lumbar region.	. . . .	Lumbar nephrectomy on 2d day; took it out in pieces; packed.	Recov. 6 weeks after injury.	Hæmaturia at time of injury; kidney surrounded by blood clots; tissue torn.
117	Seefisch, Centralbl. f. Chir., 1896, p. 139.	Run over by wagon.	Expectant.	. . . .	Recov.	Lumbar dulness; hæmaturia; collapse; peritonitis which, on 6th day, subsided.
118	Tiffany (private letter).	Fell 50 feet.	. . . .	Lumbar incision; packing.	Recov.	Large fluctuating lumbar swelling; ribs fractured; kidney ruptured from cortex into pelvis.

TABLE IV.—RUPTURE OF THE KIDNEY; PARTIAL NEPHRECTOMY.

1	Keetley, Lancet, 1890, I, 134.	Crush by wagon-wheel.	Incision; blood clot scooped out; lower end of kidney separated and removed; one vessel compressed with forceps and one with sponge	Recov.	9th, 10th, and 11th ribs broken; blood in urine 6 hours after accident; recurrent hæmorrhage in loin.
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TABLE IV.—RUPTURE OF THE KIDNEY; PARTIAL NEPHRECTOMY.—
Concluded.

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
2	Bardenheuer, Arch. klin. Chir., 1891, XLII, 371.	Blow from water-pipe.	. . . .	pressure ; forceps removed at end of operation ; sponge at end of 12 hours. Resection one-third of kidney.	Recov.	Blood and pus in urine ; piece lay 20 centimetres from rest of kidney.

TABLE V.—TRAUMATIC HYDRONEPHROSIS.

1	Croft, Brit. Med. Journ., 1881, I, 123.	Fell across a companion's back, while trying to jump over him.	Medicinal.	Aspirated 44 days after injury ; $\bar{3}$ 79, "urine-colored fluid ;" tapped 8 times, removing $3\frac{1}{2}$ gallons.	Recov.	No fluid found after the eighth tapping ; blood in urine for five days after accident.
2	May, Brit. Med. Journ., 1883, I, 108.	Kicked in the side by an officer.	. . . .	Tapped.	Recov.	Tapped once, $\bar{3}$ vii were drawn off
3	Fenger, Nordiskt Med. Arkiv, Band v, No. 12 (quoted by Staples, Journ. of the Am. Med. Assoc., Chicago, 1884, II, 393).	. . . .	. . . .	Tapped.	Death from inguinal abscess.	<i>Post Mortem</i> : Only one calyx was distended, whose orifice was obstructed by a valve-like growth.
4	Godlee, Trans. of the Clinical Society, Vol. xx.	Knocked down by a van ; horse and wheel pressed against right side.	. . . .	Abdominal incision ; $\bar{3}$ 43 turbid fluid escaped ; drainage-tube.	Recov.	Cyst was removed through the abdominal opening.

TABLE V.—TRAUMATIC HYDRONEPHROSIS.—*Concluded.*

No.	Name and Reference.	Nature of Injury.	Non-Operative Treatment.	Operative Treatment.	Result.	Remarks.
5	Postemski, Bull. Acad. Med., Roma, 1892-93, XIX, 423.	Run over.	. . . .	Nephrectomy.	Recov.	Hæmaturia; enormous hydronephrosis.
6	Richardson, Bost. Med. and Surg. Journ., July 4, 1895.	While lifting a barrel felt something give way.	. . . .	Tapped twice; f 3 l; 5 weeks after injury sac opened and drained through liver; small fistula resulted.	Recov.	Pain; vomiting; bloody stool; hæmaturia; leucocytosis; tumor from brim of pelvis to kidney.

TABLE VI.—RUPTURE OF URETER.

1	Barker, Lancet, 1885, I, 95.	Run over.	. . . .	Repeated aspiration; nephrectomy after 6 (?) wks.	Recov.	Kidney healthy; ureter ruptured; retroperitoneal pseudo-hydronephrosis.
2	Godlee, Trans. of the Clinical Soc., XX, 219.	Run over by cab.	. . . .	19 days after injury, aspirated 550 c.c. turbid, slightly alkaline urine; small amount of pus; 1 mo. after injury incised tumor, 1214 c.c. of urine and pus; 3 months and 5 days after injury nephrectomy.	Recovery 4 mos. after injury.	Urine constantly normal; no hæmaturia at any time; pain and tenderness in left lumbar and inguinal region; tumor developed in left lumbar region.